

# Lesson 14: Mars Water World

## Summary

It is hypothesized that an ocean might have existed on Mars. Students will learn what sedimentary structures and landforms in ancient, Earth, marine environments look like and the processes that formed them. From this Earth-analog approach students will observe Mars imagery and determine whether or not a Mars ocean might have existed in the distant past.

## Learning Goals

### Students will be able to:

- Identify spits on Mars and Earth and understand their formation.
- Recognize and identify carbonate rocks and the reasons for a lack of carbonates on Mars.
- Critically analyze press releases of Mars discoveries and determine what other data, if any, is needed to make the scientific findings valid.

## Context for Use

This learning module is meant for adaptation in an introductory Earth science course and/or planetary science course. The *In-Class Activities* can be easily adapted for homework when desired.

## Description and Teaching Materials

### *In-Class Activity*

In-Class Activity 1: Spits on Mars

In-Class Activity 2: Where is the carbonate on Mars?

### *Homework/Lab*

Homework 1: Mars Ocean Press Release

## Teaching Notes and Tips

1. *In-Class Activity 2*: for classes >20 students we recommend passing around several specimens of carbonate rocks and/or use an overhead microscope system for the classroom so students can observe

the texture and make observations of the carbonate rocks without a hand specimen.

2. *Homework 1*: You may need to exchange the press release articles for more current articles depending on the year in which you use this material.
3. You will often integrate the Explanation and Exploration sections of the In-Class Activities. Interact with the students as they “explore” and help them define terms/principles.

## Assessment

Each In-Class Activity and/or Homework has its own measure of Assessment.

## Mars for Earthlings

### Resources

1. Image File: [Water World](#).
2. Spit Formation in the UK and longshore drift:  
[http://www.youtube.com/watch?v=Fe9YBuK\\_qEo&feature=endscreen&NR=1](http://www.youtube.com/watch?v=Fe9YBuK_qEo&feature=endscreen&NR=1)
3. Lake Bonneville video: <http://www.youtube.com/watch?v=0SJDOluY4OI>
4. NASA Video “Keeping up with Carbon”:  
<http://www.youtube.com/watch?v=FgEZpX3n5mo>
5. Beachy Head geology: [http://www.discoveringfossils.co.uk/beachy\\_head\\_fossils.htm](http://www.discoveringfossils.co.uk/beachy_head_fossils.htm)



## Mars for Earthlings

### ***In-Class Activity 1***

Water World\_MFE

Spits on Mars

#### **Purpose:**

- Understand the concept of longshore drift and the geomorphic features it creates/develops.
- Search for and identify sand spits/tombolos on Mars

#### **Preparation:**

1. Have an Internet connection in classroom.
2. Prepare MOLA colorized elevation maps if desired (see *Exploration*)

#### **Resources:**

Spit Formation in the UK and longshore drift:

[http://www.youtube.com/watch?v=Fe9YBuK\\_qEo&feature=endscreen&NR=1](http://www.youtube.com/watch?v=Fe9YBuK_qEo&feature=endscreen&NR=1)

#### **Engage**

Have students view the following video of Spit Formation in the UK and consider the following questions:

[http://www.youtube.com/watch?v=Fe9YBuK\\_qEo&feature=endscreen&NR=1](http://www.youtube.com/watch?v=Fe9YBuK_qEo&feature=endscreen&NR=1)

1. On the beach, where would the coarsest of grain sizes be deposited (nearest the ocean or nearer the land; proximal/distal)?
2. What determines the location of particular grain sizes?
3. What governs the growth of a spit?

#### **Explore**

Using a MOLA colorized elevation map, have students do the following (students may come up to the screen and point, or students can annotate a map):

1. Mark or point to areas on Mars where spits could be present.
2. How did they make their decisions?
3. If longshore drift was present in the students' chosen regions, what direction is the longshore drift heading?

#### **Explain**

Longshore drift- caused by wave and current action. It is the primary method of sediment transport along the beach. The direction of this motion is always parallel to the beach face. This USGS website gives a description of longshore motion parallel to the beach face.

<http://geomaps.wr.usgs.gov/parks/sea/beach3.html>

Here is another short movie on longshore drift, but it does not explain that the return flow back to the ocean takes a pathway directly perpendicular to the shoreface (the shortest distance back under the influence of gravity).

<http://www.youtube.com/watch?v=rCpZYIPqn6E>



## Mars for Earthlings

### Elaborate

1. What do deposits of longshore drifts look like in cross-section? *\*Note: Have students hypothesize or draw a stratigraphic section. Provide guidance for the stratigraphic section.*
2. What determines the size of grains that are deposited?

### Evaluate

1. Students should be able to understand and use geomorphological evidence to determine if any area had a prolonged shoreline during a period in its history (This understanding will be utilized in subsequent activities).

